PROCEEDINGS OF THE

ROYAL ENTOMOLOGICAL SOCIETY

OF LONDON

SERIES C. JOURNAL OF MEETINGS

VOLUME 19. No. 11, 1954

REPORT OF THE COUNCIL, 1954

The Council presents to the Fellows of the Royal Entomological Society the report on its work and the activities of the Society in the 122nd year of its existence.

During the year 4 Honorary Fellows (Professor J. Chester Bradley, Professor C. Lindroth, Dr. R. C. L. Perkins and Dr. Hugh Scott) and 114 (93)* Ordinary Fellows have been elected. Of the latter, 88 had completed their obligation by 31st December. In addition, 14 Fellows elected in 1953 completed their obligation in 1954. Of the new Fellows who have fulfilled their obligation, 37 were under the age of 25 when elected and were, therefore, exempt from the payment of the entrance fee.

The Society has lost by death 2 Honorary Fellows (Mr. Harry Britten and Mr. H. Powell) and 11 (11) Ordinary Fellows, namely: E. Barton-White, E. A. Bowles, Malcolm Burr, Malcolm Cameron, C. A. Cheetham, W. A. Galbraith, G. E. Lodge, H. W. B. Moore, W. G. F. Nelson, J. R. le B. Tomlin and R. Senior-White.

In addition 15 (12) Fellows have resigned, namely: P. H. Abbott, Mrs. B. Burnand, J. E. Cranham, F. C. Hatwell, P. Hick, L. G. Hulls, B. Krishnamurti, T. A. Lloyd, J. Y. Moggridge, J. W. Munro, D. P. Murray, P. J. Rennie, M. G. Ridpath, J. W. Scharff and H. W. Thompson; and 22 (8) Fellows have been removed from the list in accordance with the Bye-Laws: G. F. Bartholomeuz, A. V. Bell, M. L. Braddell, H. F. Chao, N. C. Chatterji, R. D. M. Cleaver, J. C. B. Craske, N. T. Easton, A. T. Gaul, D. L. Glegg, S. H. Hazarika, P. A. D. Lanktree, O. B. Lean, J. R. Leigh, A. Malac, A. B. Misra, G. S. Noble, M. S. Quraishi, S. N. Rao, P. B. Richards, P. W. Stanley and J. Thorpe. This unusually large number of Fellows removed under the Bye-Laws is partly due to those who failed to amend the Banker's Order providing for the payment of their subscription when the amount was increased in 1948, and, their annual payment having been one guinea short each year since, the Bye-Laws regarding arrears of subscription must now operate in these cases.

The Society now consists of 22 Honorary Fellows and 1116 Ordinary Fellows, an increase of 53 (52) for the year. Of the total of 1138 Honorary and Ordinary Fellows, 651 are resident in Great Britain and 487 overseas in 62 countries.

Ten Ordinary Meetings have been held during the year, one of which, following the precedent of the meeting held in Manchester in 1951, was held in York at the end of July at the kind invitation of the Entomological Section of the Yorkshire

* Numbers in brackets throughout the Report are the corresponding figures for last year.

Naturalists' Union. Council is greatly indebted to the Rev. T. B. Kitchen, who was responsible for all the local arrangements which, in addition to the formal meeting, included a collecting trip to Askham Bog and a visit to the Spurn Peninsula, where the Society was the guest of the Ornithological Section of the Yorkshire Naturalists' Union.

The meetings have continued to be well attended, the average attendance having been 83 (97). The average attendance at the London meetings was 90. Many entomologists from overseas visited this country during the summer on the occasion of the Commonwealth Entomological Conference and it has been a pleasure to welcome them at the meetings. During the Conference a Conversazione was held in the Society's rooms in honour of the delegates, when Fellows of the Society were able to meet entomologists from abroad and each other under less formal conditions than at the Ordinary Meetings. Some 250 Fellows and Guests were present.

During the year Council has considered the possibilities of improving the Meeting Room. As a result, after detailed investigation by an expert, the installation of an up-to-date ventilation plant was approved and this equipment will shortly be in operation. In addition, a start has been made on the re-upholstery of the seating benches and six new benches have been acquired.

An annual volume of the *Transactions* and of the three series of *Proceedings* has appeared, as usual, as well as four further parts of the *Handbooks* series.

The *Transactions* for 1954 (Volume 105) consists of 527 pages and contains 21 papers, of which 3 deal with Diptera, 3 with Hymenoptera, 3 with Orthoptera, 2 with Coleoptera, 2 with Homoptera, 2 with Thysanoptera, 2 with Ephemeroptera, and 1 each Hemiptera, Lepidoptera, Mallophaga, and General Entomology. The volume is illustrated by 1 coloured and 12 half-tone plates, as well as numerous text-figures.

Council is grateful to the Anti-Locust Research Centre for defraying the cost of the plates illustrating Dr. Popov's paper, and to Mr. T. H. E. Jackson for providing the two plates illustrating the paper by Monsieur Stempffer. The Society is again indebted to the Royal Society for a grant from the Scientific Publications Grant-in-Aid, towards the cost of publishing a large paper by Dr. Higgins dealing with the genus *Mellicta* Billberg. The paper, which will include a coloured plate, is in the press and should appear in the early spring.

The *Proceedings* were continued as follows :

Series A (General Entomology). Volume 29 consists of 182 pages and contains 33 papers, illustrated by 3 plates and many text-figures.

Series B (Taxonomic Entomology). Volume 23 consists of 245 pages and contains 37 papers, illustrated by 1 coloured and 1 half-tone plate, as well as numerous text-figures.

Series C (Journal of Meetings). A part of *Series C* has been sent to every Fellow in advance of Meetings and a complete volume will be issued with the last part.

Four additional parts of the *Handbooks for the Identification of British Insects* have appeared, namely :

Vol. I, Part 2.—Thysanura and Diplura. By M. J. Delany.
Vol. IV, Part 8 (*a*).—Coleoptera : Staphylinidae (part). By C. E. Tottenham.
Vol. V, Part 9.—Coleoptera : Lagriidae to Meloidae. By F. D. Buck.
Vol. X, Part 4 (*a*).—Diptera : Cyclorrhapha (part). By F. I. van Emden.

A revised edition of Volume IX, Part 1, was also published during the year, the original edition having been exhausted. The stock of Volume 1, Part 5, is also exhausted and a new edition is being prepared. Seventeen parts in this

series have now been published and the demand for them is welcome evidence that they are meeting a real need. Further parts are in preparation.

Work is also in progress on a special volume of the *Transactions*, to appear in 1955, in honour of Dr. Karl Jordan. In addition to the scientific papers the volume will contain appreciations of Dr. Jordan's work, a bibliography of his published writings and other matter appropriate to such a volume. The work will form Volume 107 of the *Transactions*.

Use of the Library has grown during the year, the number of books issued being 2002 (1748) and the number of borrowers 1075 (906). These figures, of course, apply only to books which are sent or taken away on loan. A very much larger number of books are used by Fellows in the Library. In addition, 131 (185) loans were made to the National Central Library, of which the Society is an outlier.

It has also been possible to make some progress in dealing with the large collection of uncatalogued or imperfectly catalogued separates.

Early in the year the Society was able to purchase a copy of a rare work, Antonio Berlese's *Acari myriopoda et scorpiones hucusque in Italia reperta*, Patavii, 1882–1897. This is complete except for the small section on scorpions, and has been bound in five volumes.

As a service to Fellows resident abroad it has been decided to extend the lending service to allow separates to be sent overseas and to supply on loan photostats of papers where separates are not available.

The detailed work of the Society's affairs has again been guided by the Finance and House Committee under the chairmanship of Dr. J. W. Evans and, after Dr. Evans's departure for Australia, that of Dr. K. Mellanby, and by the Publication and Library Committee under the chairmanship of Professor O. W. Richards. Council is grateful to the Fellows who have served on these Committees.

The Committee for the Protection of British Insects has not had occasion to hold a meeting during the year. The Society keeps in touch with the Nature Conservancy and most of the matters formerly dealt with by the Committee are now taken care of automatically by that body. The future of the Committee is under consideration.

At the end of 1953, a Sub-Committee was set up to consider the Society's development policy, and several meetings were held early in the year. The future was considered in the light of the forthcoming move of the Commonwealth Institute of Entomology which will enable the Society to take over much needed additional office and storage space with, however, consequent loss of income.

The improvements in the Meeting Room already referred to were part of the Sub-Committee's recommendations subsequently adopted by Council. An extension of the Society's activities to include all land Arthropods was also proposed and steps have been taken to ascertain the view of Fellows on this matter. The response was favourable and it may be possible to implement the proposal by the initiation of a new journal devoted to papers on Arachnids and closely allied groups in 1956 and by expanding the scope of the Library to correspond.

The Treasurer has continued to represent the Society at the Meetings of the Parliamentary and Scientific Committee and of the Biological Council.

At the end of December Dr. E. B. Ford retired from his position as the Society's representative on the National Committee for Biology and Mr. N. D. Riley was appointed to serve in his stead for the six-year period commencing in January, 1955.

The Society was again represented at the British Association's Oxford meeting,

when Professor G. C. Varley, Dr. B. M. Hobby and Professor W. A. F. Balfour-Browne acted as the Society's delegates.

Council was privileged to be associated with the Sesquicentenary Celebrations of the Royal Horticultural Society, which were held in July, when an address was presented comprising a selection of insects accompanied by an appropriate inscription.

Messages of congratulations were also sent to Mr. Cecil Warburton on the occasion of his hundredth birthday in February, to Dr. Henri Schouteden on the Jubilee Celebration in his honour organised by the Musée Royal du Congo Belge, Tervueren, and to the University of Pavia on the occasion of the ceremony to celebrate the centenary of the birth of Professor Battista Grassi.

Council wishes to record the pleasure with which they received the information that Dr. E. B. Ford has received the Royal Society's Darwin Medal, that Miss Cheesman, now on an expedition to the New Hebrides, had received the O.B.E. in the New Year's Honour's List, and that Dr. C. B. Williams had been elected a Fellow of the Royal Society.

During the Editor's absence in South-West Africa, from February to September, his duties were assumed by the Honorary Secretary, assisted by Mr. N. D. Riley.

The Treasurer also made a short visit to Uganda in the early summer.

Ciné films were made by the Treasurer and the Editor during these visits and it is hoped to show them at a forthcoming meeting.

Sergeant Campbell, who joined the Society's staff as caretaker/housekeeper early in the war, resigned in October to take up another appointment. Sergeant W. H. Allen has been appointed in his stead.

THE ROYAL ENTOMOLOGICAL SOCIETY OF LONDON

STATEMENT OF INCOME AND EXPENDITURE for the Year ended 31st December, 1954.

(Presented at the Annual Meeting, 2nd February, 1955.)

GENERAL FUND.

INCOME.

1953. £		£ s. d.	£ s. d.
	To Subscriptions—		
148	Received in advance for 1954	130 10 5	
2,900	Received in 1954 for 1954	3,132 8 10	
102	Received in 1954 for previous years ..	157 16 5	
3,150		3,420 15 8	
125	*Less:* Subscriptions in arrear at 31st December, 1953, valued at	150 0 0	
3,025		3,270 15 8	
150	*Add:* Subscriptions in arrear at 31st December, 1954, valued at	125 0 0	
3,175			3,395 15 8
183	„ Income Tax Recovered in respect of Covenanted Subscriptions		193 14 2
414	„ Transfer from Capital Reserve Fund— Interest on Investments (gross) ..		444 1 10
463	„ Transfer from Hugh Main Fund— Interest on Investments (gross) ..		463 3 3
	„ Publications—		
4,284	Sales	3,922 11 4	
531	Transfer from Library Fund— Value of Exchanges	481 1 0	
4,815			4,403 12 4
	„ Sub-Tenants—		
532	Rent	532 0 0	
366	Contributions to House Expenses ..	372 19 3	
898			904 19 3
44	„ Interest—Post Office Savings Bank ..		57 14 2
£9,992			£9,863 0 8

EXPENDITURE.

1953. £		£ s. d.	£ s. d.
	By House Expenses—		
425	Wages	499 16 2	
174	Fuel, Gas and Electric Light ..	178 11 1	
54	Insurance	57 16 1	
26	Water	25 15 10	
	Repairs and Improvements Fund—		
1,200	Transfer	200 0 0	
85	Miscellaneous	63 5 4	
1,964			1,025 4 6
	„ Office and Meeting Expenses—		
1,672	Salaries	1,961 18 4	
152	Printing and Stationery	154 3 6	
155	Postage and Telephone	207 14 4	
45	Office Equipment	55 0 0	
63	Audit Fee	63 0 0	
50	Legal Expenses	10 0 0	
10	Superannuation	10 0 0	
—	Conversazione	194 15 3	
75	Cine-Camera	— — —	
24	Films	35 0 0	
98	Miscellaneous	143 5 9	
2,344		2,834 17 2	
	Less: Proportion of Salaries, Stationery and Postage allocated to "Handbooks of British Insects"	225 0 0	
2,344			2,609 17 2
	„ Library Fund—		
524	Transfer	469 3 3	
531	do. Value of Exchanges	481 1 0	
1,055			950 4 3
	„ Publications—		
4,998	Expenditure	5,197 9 1	
	Less Grants and Donations £40 0 0		
800	Westwood Bequest 14 7 8		
4,198		54 7 8	
			5,143 1 5
	„ Donations—		
25	*Zoological Record*	25 0 0	
25	International Trust for Zoological Nomenclature	25 0 0	
—	British Co-ordinating Committee for Nature Conservation	3 0 0	
5	Wicken Fen Fund	5 0 0	
5	Oxshott Heath Conservators	— — —	
3	Committee for the Protection of British Insects	— — —	
63			58 0 0
368	„ Excess of Income over Expenditure for year carried to Balance Sheet ..		76 13 4
£9,992			£9,863 0 8

STATEMENT OF INCOME AND EXPENDITURE for the year ended 31st December, 1954.

LIBRARY FUND.

1953.		Income.	£ s. d.	£ s. d.
£	£			
		To Interest on Investment—		
32		Hamilton Druce Bequest Fund		32 10 0
		„ General Fund—		
	524	Transfer	469 3 3	
	531	do. Value of Exchanges	481 1 0	
1,055				950 4 3
£1,087				£982 14 3

1953.		Expenditure.	£ s. d.	£ s. d.
£	£			
	264	By New Books	337 17 6	
	260	„ Binding, Repairs and Insurance ..	131 5 9	
	524			469 3 3
		„ Transfer to Sales of Publications—		
	531	Value of Exchanges		481 1 0
		„ Excess of Income over Expenditure		
	32	for year carried to Balance Sheet ..		32 10 0
£1,087				£982 14 3

REPAIRS AND IMPROVEMENTS FUND.

1953.	Income.	£ s. d.
£		
1,200	To General Fund—Transfer	200 0 0
—	„ Excess of Expenditure over Income for year carried to Balance Sheet	2,051 6 0
£1,200		£2,251 6 0

1953.	Expenditure.	£ s. d.
£		
806	„ Repairs, and Improvements	2,251 6 0
394	By Excess of Income over Expenditure for year carried to Balance Sheet	— — —
£1,200		£2,251 6 0

SPECIAL PUBLICATIONS FUND.

1953.	Income.	£ s. d.
£		
22	To Sales	3 5 3
£22		£3 5 3

1953.	Expenditure.	£ s. d.
£		
22	By Excess of Income over Expenditure for year carried to Balance Sheet	3 5 3
£22		£3 5 3

HANDBOOKS OF BRITISH INSECTS.

1953.	Income.	£ s. d.
£		
891	To Sales	1,281 15 8
—	„ Excess of Expenditure over Income or year carried to Balance Sheet	39 1 7
£891		£1,320 17 3

1953.	Expenditure.	£ s. d.
£		
688	By Printing	1,095 17 3
—	„ Proportion of Salaries, Stationery and Postage	225 0 0
203	„ Excess of Income over Expenditure for year carried to Balance Sheet	— — —
£891		£1,320 17 3

BALANCE SHEET, 31st December, 1954.

GENERAL FUND.

	£ s. d.	£ s. d.
Sundry Creditors		1,848 6 0
Provision for Estimated Cost of Outstanding Publications		300 0 0
Grant towards Publications—unspent		400 0 0
Subscriptions received in Advance		196 0 10
EXCESS OF ASSETS OVER LIABILITIES—		
As at 31st December, 1953	1,015 10 2	
Add Excess of Income over Expenditure for year to date	76 13 4	
		1,092 3 6
		£3,836 10 4

	£ s. d.	£ s. d. (Not valued)
Stock of Publications		
Sundry Debtors—		
Subscriptions valued at	125 0 0	
Publications valued at	1,050 0 0	
Rents and Contributions to House Expenses	233 2 3	
Income Tax Recoverable	11 18 5	
		1,420 0 8
Insurance Premiums prepaid		225 0 0
Balance at Bank—		
Post Office Savings Bank	7 6 9	
Current Account	1,949 13 7	
Petty Cash Account	193 10 1	
		2,150 10 5
Cash in Hand		40 19 3
		£3,836 10 4

(In addition to the above, the Society holds a sum of £582 8*s.* 7*d.* on behalf of the Permanent Committee of the International Congress of Entomology)

RECONCILIATION OF CASH BALANCES—

	£ s. d.	£ s. d.
Post Office Savings Bank—		
General Fund	7 6 9	
Library Fund	337 5 3	
Repairs and Improvements Fund	1,263 2 5	
Special Publications Fund	159 6 6	
Handbooks of British Insects	434 19 5	
Capital Reserve Fund	139 9 0	
Hamilton Druce Bequest Fund	66 19 6	
		£2,408 8 10
Current Account—		
General Fund		£1,949 13 7
Petty Cash Account—		
General Fund		£193 10 1
Cash in Hand—		
General Fund		£40 19 3

BALANCE SHEET, 31st December, 1954.

LIBRARY FUND.

	£ s. d.	£ s. d.		£ s. d.	£ s. d.
Sundry Creditors		46 1 6	Library Furniture and Fittings		(Not valued)
EXCESS OF ASSETS OVER LIABILITIES—			Library Books (valued at £22,000)		—
As at 31st December, 1953	1,555 16 3		Investments at Cost—		
Add Excess of Income over Expenditure for year to date	32 10 0		£200 3% Savings Bonds 1955/65	200 0 0	
		1,588 6 3	£1,079 5*s.* 5*d.* 3% Funding Loan 1959/69	1,001 2 6	
			(*Market Value at date* £1,247.)		1,201 2 6
			Insurance Premiums prepaid		96 0 0
			Balance at Bank—Post Office Savings Bank		337 5 3
		£1,634 7 9			£1,634 7 9

REPAIRS AND IMPROVEMENTS FUND.

	£ s. d.	£ s. d.		£ s. d.	£ s. d.
Sundry Creditors		2,251 6 0	Investments at Cost—		
EXCESS OF ASSETS OVER LIABILITIES—			£750 3% War Stock 1955/59	754 6 8	
As at 31st December, 1953	2,414 12 1		£627 10*s.* 3% British Transport Stock 1978/88	596 13 0	
Less Excess of Income over Expenditure for year to date	2,051 6 0		(*Market Value at date* £1,304.)		1,350 19 8
		362 16 1	Balance at Bank—		
			Post Office Savings Bank		1,263 2 5
		£2,614 2 1			£2,614 2 1

SPECIAL PUBLICATIONS FUND.

	£ s. d.	£ s. d.		£ s. d.	£ s. d.
EXCESS OF ASSETS OVER LIABILITIES—			Investments at Cost—		
As at 31st December, 1953	587 8 6		£250 3% War Stock 1955/59	251 8 10	
Add Excess of Income over Expenditure for year to date	3 5 3		£195 3% British Transport Stock 1978/88	179 18 5	
		590 13 9	(*Market Value at date* £422.)		431 7 3
			Stock of Publications		(Not valued.)
			Balance at Bank—		
			Post Office Savings Bank		159 6 6
		£590 13 9			£590 13 9

BALANCE SHEET, 31st December, 1954.

HANDBOOKS OF BRITISH INSECTS.

	£ s. d.	£ s. d.		£ s. d.	£ s. d.
Sundry Creditors		285 10 3	Investment at Cost—		
Excess of Assets over Liabilities—			£390 3% British Transport Stock 1978/88		359 16 10
As at 31st December, 1953	948 7 7		(*Market Value at date* £341.)		
Less Excess of Expenditure over Income for Year to date	39 1 7		Stock of Publications		(Not valued)
		909 6 0	Sundry Debtors for Publications valued at		400 0 0
			Balance at Bank—		
			Post Office Savings Bank		434 19 5
		£1,194 16 3			£1,194 16 3

CAPITAL RESERVE FUND.

	£ s. d.	£ s. d.		£ s. d.	£ s. d.
Excess of Assets over Liabilities—			Freehold Premises, 41, Queens Gate, S.W.		(Not valued)
As at 31st December, 1953	9,507 2 2		(Cost including Alterations, £13,417.)		
Add Admission Fees received during year	142 16 0		Investments at Cost—		
Interest on Investments	444 1 10		£3,500 3% Redemption Stock 1986/96	3,334 0 3	
	10,094 0 0		£600 3½% War Stock	609 2 0	
Less Transfer to General Fund Income and Expenditure Account—			£4,127 17*s.* 6*d.* 2½% Consols	3,352 2 7	
Interest on Investments	444 1 10		£1,165 3% British Transport Stock 1978/88	1,108 3 3	
	9,649 18 2		£2,639 0*s.* 4*d.* 2½% Treasury Stock, 1975	1,715 4 0	
Staff Provident Fund—			(*Market Value at date* £9,054.)		10,118 12 1
As at 31st December, 1953	608 2 11		Balance at Bank—		
		10,258 1 1	Post Office Savings Bank		139 9 0
		£10,258 1 1			£10,258 1 1

THE HUGH MAIN FUND FOR THE ADVANCEMENT OF ENTOMOLOGY.

	£ s. d.	£ s. d.
EXCESS OF ASSETS OVER LIABILITIES—		
As at 31stDecember, 1953	12,827 8 10	
Add Interest received during year on Investments ..	463 3 3	
	13,290 12 1	
Less Transfer to General Fund Income and Expenditure Account—		
Interest on Investments	463 3 3	
		12,827 8 10
		£12,827 8 10

	£ s. d.	£ s. d.
Investments—		
Transferred by Trustees—at Market Value at date of transfer—		
£400 3% Savings Bonds 1960/70	384 0 0	
£4,000 3% British Electricity Stock 1968/73	3,596 17 8	
£5,000 3% British Electricity Stock 1974/77	4,100 0 0	
£5,312 3*s.* 7*d.* 3% British Transport Stock 1978/88 ..	4,037 4 9	
Investment of Cash paid over by Trustees £872 2*s.* 6*d.*		
2½% Consols	622 12 5	
(*Market Value at date* £14,082.)		12,740 14 10
Income Tax Post War Credit Certificates		86 14 0
		£12,827 8 10

TRUST FUNDS.

	£ s. d.	£ s. d.
HAMILTON DRUCE BEQUEST FUND—		
As at 31st December, 1953	1,095 15 6	
WESTWOOD BEQUEST FUND—		
As at 31st December, 1953	250 0 0	
	£1,345 15 6	

	£ s. d.	£ s. d.
HAMILTON DRUCE BEQUEST—		
Investments—		
£406 2*s.* 2*d.* Mersey Docks and Harbour Board 3¼% Annuities at Cost	418 11 6	
£593 17*s.* 10*d.* ditto transferred from Capital Reserve Fund in 1946 at Market Value	610 4 6	
(*Market Value at date* £725.)	1,028 16 0	
Balance at Bank—		
Post Office Savings Bank	66 19 6	
		1,095 15 6
WESTWOOD BEQUEST—		
Investment at Cost—		
£239 12*s.* 4*d.* Birmingham Corporation 3% Stock, 1947		250 0 0
(*Market Value at date* £180.)		
		£1,345 15 6

(*Sgd.*) N. E. HICKIN, *Hon. Treasurer.*

We have examined the foregoing Balance Sheets and Accounts with the Books and Vouchers of the Society, and certify them to be in accordance therewith. We have verified the Investments and Bank Balances and the Solicitors have certified to us that they hold the Deeds of No. 41, Queens Gate for safe custody on behalf of the Society.

Finsbury Circus House,
Blomfield Street,
London, E.C.2.
21st January, 1955.

(*Sgd.*) W. B. KEEN & Co.,
Chartered Accountants.

COMMITTEE FOR THE PROTECTION OF BRITISH INSECTS.

RECEIPTS AND PAYMENTS ACCOUNT for the year ended 31st December, 1954.

RECEIPTS.	£	s.	d.	PAYMENTS.	£	s.	d.
To Balance at Bank 1st January, 1954	33	5	10	By Balance at Bank 31st December, 1954	36	8	10
,, Donations	3	3	0				
	£36	8	10		£36	8	10

(*Sgd.*) H. M. EDELSTEN, *Hon. Treasurer.*

We have audited the above Account of Receipts and Payments and certify it to be correct.

Finsbury Circus House,
Blomfield Street,
London, E.C.2.
21st January, 1955.

(*Sgd.*) W. B. KEEN & Co., *Chartered Accountants.*

WICKEN FEN FUND.

RECEIPTS AND PAYMENTS ACCOUNT for the year ended 31st December, 1954.

RECEIPTS.	£	s.	d.	£	s.	d.	PAYMENTS.	£	s.	d.
To Balance at Bank 31st December, 1954				1	1	0	By Printing, Stationery and Postage	5	11	8
,, Legacy by the late H. B. C. White, Esq.	100	0	0				,, Donation to the National Trust	142	10	4
,, Donations	47	1	0							
				£147	1	0				
				£148	2	0		£148	2	0

(*Sgd.*) H. M. EDELSTEN, *Hon. Treasurer.*

We have audited the above Account of Receipts and Payments and certify it to be correct.

Finsbury Circus House,
Blomfield Street,
London, E.C.2.
21st January, 1955.

(*Sgd.*) W. B. KEEN & Co., *Chartered Accountants.*

TREASURER'S REPORT

Dr. N. E. Hickin said :

Mr. President and Fellows : It is my privilege this afternoon to put before you my Third Annual Report as Treasurer of the Society.

The past year has seen the Society growing steadily and it is very pleasing for me to state that the financial strength of the Society has been in no way impaired by the heavy committments during 1954.

If we add our income to the General Fund (£9863), to that resulting from sales of the *Handbooks* in the Handbooks Fund (£1282), Fellows will see that our gross income at £11,145 is a record for the Society.

Income from Fellows' Subscriptions rose by £200 and it is of great interest to note that 37 Fellows below the age of 25 were elected during the year, and thus were elected without entrance fee. I am sure that Fellows will agree that this scheme, which was one of several initiated by the Council to perpetuate the name of our great benefactor, Hugh Main, was a very wise decision and cannot but be a source of great strength to the Society.

Following the last Annual Meeting of the Society, a reminder was sent to Fellows concerning the payment of subscriptions under the covenant scheme. I am glad to report that the Society expects to benefit from 31 additional covenanters when the next claim is due to be made.

With regard to the *Handbooks for the Identification of British Insects*, four further parts were issued during the year, and our total sales for *Handbooks* was £1281. The cost of printing the *Handbooks* is met from a separate fund which, after an initial grant from the Royal Society, is now self-supporting. In previous years only the annual cost of printing was charged to this fund—all other costs, such as stationery, clerical assistance, etc., were borne out of our general income. It will be realised that the overhead expenses in producing the works and the cost of clerical assistance in handling, are heavy, so that in our present accounts that I am putting before you, you will see that part of the salary of an additional member of the staff engaged, together with post and stationery costs, are, for the first time, charged to the fund this year.

It will be seen from the statement of Income and Expenditure that there is an apparent decrease in sales of our *Transactions* and *Proceedings*, but I want to emphasise that this is not due to a decrease in demand for our publications, but is in a large measure due to the time of publication of a part subsidised by a grant from the Royal Society during 1954. Had this part been published during 1954 our income from Publications would have shown an increase over last year's figures.

I have now to report on the expenditure side, but with perhaps not quite as much bravado, that our gross expenditure for the year 1954, at £13,158, was also a record. This is made up from our expenditure from the General Fund of £9786, £1321 from the Handbooks Fund and £2051 from the Repairs Fund. Fellows will recall that it is not the Society's policy to build up Capital Reserves indefinitely, and that last year the Repairs Fund was re-named Repairs and Improvements Fund, and £1000 in addition to the usual allocation of £200 was placed to it. We have spent £2251 on repairs and improvements during 1954 and I am sure it will please Fellows to learn that it has been possible to meet the very heavy bills for new benches for the Meeting Room, and the repair and re-upholstering of the old benches, and for an up-to-date ventilation plant installed

here in the Meeting Room, without unduly upsetting our finances. Furthermore, it is possible to meet the heavy bills from our first reserves in the Post Office Savings Bank, and there has been no need to disturb our investments.

You will see that a balance still exists in our Repairs and Improvements Fund of £363.

In the Library we have spent £373 on purchase of books—£73 more than last year—but only £131 on binding, which is only half of that spent last year. Our General Fund shows an excess of Income over Expenditure of £76.

Fellows will recall that in my last Annual Report I drew attention to a substantial loss of income which the Society would experience when the Commonwealth Institute of Entomology gave up their tenancy of our rooms. This did not happen as expected during 1954 but will take place during 1955, and proper note will be taken of it when my budget for 1955 is put before the Finance and House Committee.

Now I have several important debts to bring to the notice of Fellows, debts which the Society owes to its President for his services to the Society during this past year. There have been many matters of much weight discussed by Council and the Committees of Council, much of which will involve the Society during the coming years, and as Treasurer I am very grateful for the benefit of our President's long experience and unfailing logic.

I am also very grateful to the Hon. Secretary for the vast amount of careful detailed work which he enthusiastically accomplishes for the Society. Likewise to our Hon. Editor my thanks must go. Much arduous work has been undertaken during 1954 and I am sure Fellows will agree with me that he has accomplished this work with distinction.

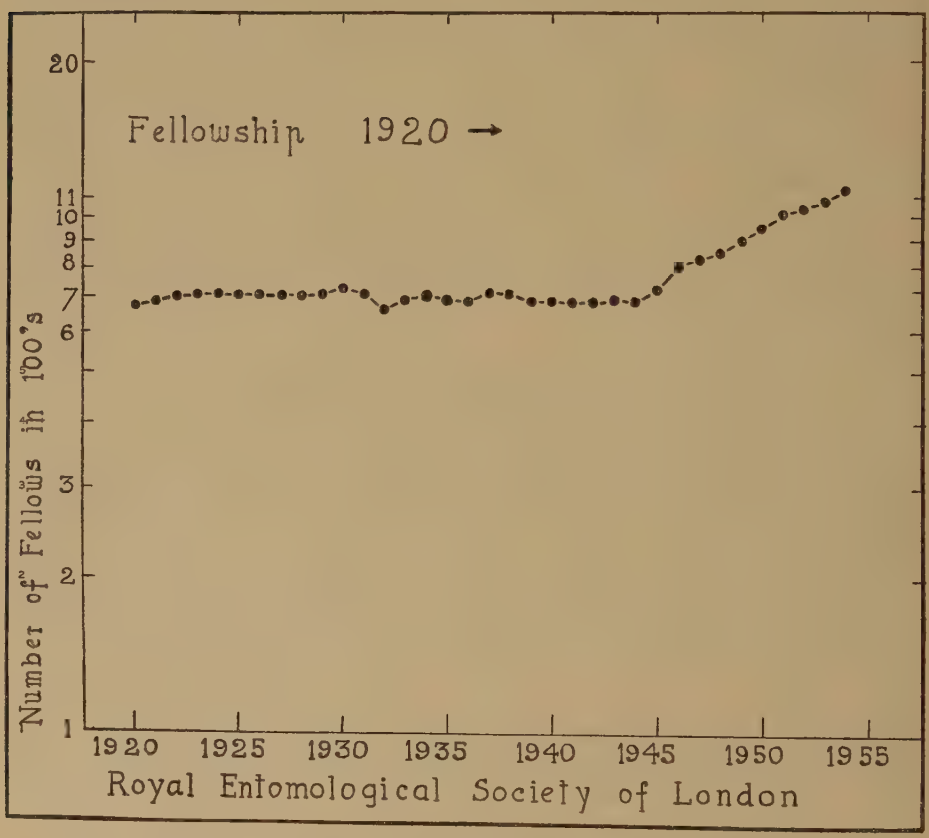
The Finance and House Committee has, during the past year, had as Chairman Dr. J. W. Evans, and then, on his resignation, Dr. K. Mellanby. I wish to thank them both for their help and guidance.

Those Fellows who examine our accounts regularly each year must be struck by the growing volume of our work, and by far the greater responsibility for the smooth running of our Society must rest with our Registrar, and I would, this year, like to congratulate Miss Evans and her staff on the work accomplished during 1954.

Now my final thanks to our Auditors, Messrs. W. B. Keen & Co., who take such an interest in our work, and a copy of our Balance Sheet and Accounts is on the table in front of me for examination by any Fellows who may wish to do so.

The President's Remarks

The PRESIDENT (Professor P. A. BUXTON) in commenting on the reports of the Council and on the Treasurer's Statement for the year 1954, felt optimistic. The Council had felt able to incur additional expenditure and he felt clear that they had acted wisely in doing so. The Society was better able to do this partly because of the net increase in the Fellowship which was still about 50 per year; also because of the large sum that had come to us under the will of the late Mr. Hugh Main.



As to the numbers of Fellows, a graph showed that the total had been close to 700 for many years in the period before the war and indeed until 1945. After that, doubtless in part owing to substantial Government support for scientific work and an increased number of appointments for entomologists, there had been an increase in every year, so that the net figure now exceeds 1100. This was certainly encouraging, but the President pointed out that the *rate* of increase was probably beginning to fall off. This is evident from the graph which had been drawn on a logarithmic scale, so that if the increase had been at a steady rate it would have appeared as a straight line. He felt that it would be wise for the Council to expect the membership to become stable in a few years.

The President then referred to the installation of plant for supplying an adequate amount of warm air to the Meeting Room, an important and long overdue improvement in our amenities. He took the opportunity of thanking his colleague, Dr. T. C. Angus for advice on technical problems involved.

The amount of scientific work published was greater than the normal, gratifying indeed, but giving much additional work to the Editor and staff whose work in the background was perhaps not always remembered or appreciated. As to the Library, one might wonder whether Fellows made full use of the large collection of reprints indexed and available.

The President then referred briefly to an alteration in the Society's affairs which has come into effect from the beginning of January, 1955. The Council, having gone most carefully into the conditions of employment of the staff, had decided to introduce scales, which give a prospect of a steady rise in salary for some years ahead, an advantage to the Officers and also to the Council which can estimate its maximum commitments. A system of pensions has also been introduced. He felt gratification that in these two ways the position of the staff, whose work contributes so much to the welfare of the Society, has been improved and strengthened.

In conclusion he thanked the Officers and staff for their constant help and collaboration and the Society which had allowed him to be President for two years, and he gave his best wishes to the incoming President.

THE PRESIDENT'S ADDRESS

During the year 1954 the Society has lost by death two Honorary Fellows and twelve Ordinary Fellows.

Harry Britten, born 3rd September, 1870, died 31st January, 1954, was elected to the Society in 1909 and was made a Special Life Fellow in 1948. Early in life he worked in Cumberland as a gamekeeper and acquired an immense knowledge of field natural history, including both plants and insects of several orders. His exceptional neatness of hand, and his very observant eyes led to his collecting minute insects and mounting them with quite remarkable skill and success. This ability led to his being appointed to the staff of the Hope Department at Oxford in 1913. Later, after an interval, he was appointed to the Manchester Museum, where he served on the staff from 1919 to 1937, working in the Museum after that almost to the time of his death. His collections are in that Museum, but much of the material that he collected is elsewhere, for he was a man of the greatest generosity. Papers on the Coleoptera of Britain and indeed on other orders as well make numerous references to specimens collected by Harry Britten. It is unfortunate that he could seldom be moved to publish what he knew. A man who knew him well has described him as " a simple, good-humoured and friendly man, with a peculiar quality of personal charm ".

Harold Powell was elected to the Society in 1905 and became a Special Life Fellow in 1931. He worked as a pharmacist first in Hyères, France, and then in Algiers and more than one place in Morocco. Towards the end of his life he opened his " Pharmacie des Lycènes " at Ifran, in the Middle Atlas. He was a personal friend of those British collectors who visited the South of France forty or fifty years ago, such men as Chapman, Rowland Brown, Bethune-Baker and Sheldon. He made very large collections of Lepidoptera, some of which passed to the collection of Oberthür and he published on a part of his collections in the *Etudes de Lépidoptérologie comparée.* Powell excelled as a student of

early stages of Lepidoptera. His material is continually referred to in the publications of Oberthür.

E. Barton White was a Fellow of the Society from 1910-1954. He was interested in British insects, particularly in varieties of Lepidoptera, and among other things he assembled a remarkable collection of varieties of *Arctia caja*.

Edward Augustus Bowles, who was born in 1865, was elected a Fellow of our Society in 1894. His garden near Enfield and his handbooks of *Crocus*, *Colchicum* and *Narcissus*, often illustrated from his own water colours, are well known. His main interest was in horticulture, and he served the Royal Horticultural Society for many years in many capacities. Early in life he had general entomological interests, particularly in the relation between garden plants and insect pests and pollinators. He was actively concerned with the entomological work at the Royal Horticultural Society's garden at Wisley, and with the investigations carried out there by the late Mr. Fox-Wilson.

Malcolm Burr was born in 1878 and elected to our Society in 1896, serving twice on the Council and as Vice-President in 1912. He was a versatile, unpredictable man, not always successful. It is curious, and typical, that at Oxford he obtained an indifferent degree in Modern History (1900) followed by a D.Sc. (1909) for a group of entomological papers. In entomology his principal interest was the Orthoptera, including the Dermaptera, and it is characteristic that he produced a small book on British Orthoptera before he was twenty years old. Before 1914 he travelled very widely in the Balkans and elsewhere, and produced a number of papers on the Orthoptera. He also amassed a collection of Dermaptera, partly by writing innumerable letters to such men as British consuls in all parts of the globe. On the earwigs he wrote an important volume in the *Fauna of British India* (1910) and in *Genera Insectorum* (1911). His knowledge of the earwigs was very great, indeed more than any man Burr has put the taxonomy of that group on a firm basis. The war of 1914–18 made a great interruption in his life; after it Burr scarcely returned to serious entomology, though he published several popular books, of which perhaps the best known is *Insect Legion*; there were others on his travels in the Balkans and Angola.

Burr was an extremely quick linguist with a wonderful memory, even for languages which he had not spoken for many years. We believe that prior to 1914 he spoke the language of every capital in Europe as it then was, including Russian, Serb and Turkish. In 1910 Malcolm Burr went as the delegate of our Society and of other British societies to the Jubilee of the Entomological Society of Russia; he appeared in the scarlet gown of an Oxford D.Sc. and addressed the gathering in Russian.

Malcolm Cameron, born in 1873, was elected to our Society in 1902 and served on the Council from 1919. Professionally he was a medical man and saw active service in the Boer War and in 1914–18, serving on H.M.S. " Cornwall " in the Battle of the Falkland Islands and later in the East African Campaign. During this period he made a large general collection of Coleoptera, which was presented to the British Museum in 1936. From about 1920, when he had retired from the Naval Medical Service, he devoted himself to entomology and worked for a period in the Indian Forest Research Institute at Dehra Dun. Returning to London in 1925, he produced five volumes on the Staphylinidae of India, in the *Fauna of British India*. He published many other papers on that family. Cameron's collection of Staphylinidae has been bequeathed to the British Museum (Natural History). The arranged part of the collection amounts to some 35,000 specimens of 9200 species, of which 2230 are represented by holo-

types and a further 1064 by paratypes. In addition there is an enormous amount of duplicate and unworked material.

Christopher A. Cheetham (born 1875) was a Fellow of our Society from 1920 to the time of his death in June, 1954. For very many years he was an active member of the Yorkshire Naturalists' Union and most of his work was confined to that county, though he paid a number of visits to several parts of Ireland, the Hebrides and so forth. He had an excellent knowledge of botany, including the mosses. As an entomologist he worked principally upon the Diptera, acting as Recorder of Diptera for the Yorkshire Naturalists' Union and publishing a series of papers in *The Naturalist*.

George Edward Lodge, born in 1860, was elected a Fellow of the Society in 1920. He became a wood engraver, particularly of drawings of birds by himself or other well-known artists, among others J. G. Milais. Later in life Mr. Lodge turned more and more to painting birds, mostly in water-colour and later in tempera. He had a number of open air and sporting recreations, and was interested among other things in entomology, particularly in the British Lepidoptera.

W. G. F. Nelson was a Fellow of our Society from 1919 until his death in 1954, and served on the Council from 1922–24. He formed a large collection of British butterflies, moths and beetles, but ceased to work in that field many years ago. He was by profession a solicitor and at the time of his death senior partner in the firm of Pennington & Son, of Lincoln's Inn Fields. He served the Society for many years as its legal adviser.

Ronald Senior-White, who was a Fellow of our Society from 1918 until his death in October, 1954, went to Ceylon as a young man and rapidly developed an intimate knowledge of mosquito breeding places and control of mosquitoes and malaria. After a few years he moved to India where he served as the malariologist of the Bengal Nagpur Railway, living in Calcutta, and travelling very widely. His earliest published notes were on the Lepidoptera of Ceylon (1918); these were followed by papers on the mosquitoes of Ceylon (1919–1921), and much work on mosquitoes of India (1922, onwards). He had a very wide interest in the Diptera and contributed a number of articles to the *Catalogue of Indian Insects*. He also wrote the volume on Calliphoridae in the *Fauna of British India* (1940), collaborating there with Miss D. Aubertin and Dr. J. Smart. It was a matter of great satisfaction to him that he served as a malariologist in the Indian Medical Service, with the rank of Major. When he retired from India he took a position in Trinidad and worked on the biology of *Anopheles*, particularly *A. aquasalis*, for several years. He was an extremely energetic field worker and an acute and original observer.

J. R. J. Llewellyn Jones died in Vancouver, Columbia, in November, 1954. He had made an extensive collection of Lepidoptera in southern British Columbia and he left this, together with his entomological books and apparatus, to the University of British Columbia. He was particularly interested in the food-plants of these insects and published a series of papers on that subject in the *Proceedings of the Entomological Society of British Columbia* (1933 onwards). He is spoken of as an active President of the Entomological Society of British Columbia, and a very retiring student of his chosen group.

J. R. le B. Tomlin was elected in 1897, and frequently attended our meetings years ago. He made a very large collection of British Coleoptera (80,000 specimens) and Mollusca, which he presented to the National Museum of Wales, of

which he was a Life Governor. His advanced age, for he died at 91 in December, 1954, must account for the fact that few among us knew him personally.

H. W. B. Moore, elected in 1927 died in New York in 1952.

The Society has recently heard of the death of W. A. Galbraith elected in 1941.

Presidential Address to the Fellows of the Royal Entomological Society of London delivered by

PROFESSOR P. A. BUXTON, C.M.G., F.R.S.,

at the Annual Meeting on Wednesday, 2nd February, 1955.

TSETSE AND CLIMATE: A CONSIDERATION OF THE GROWTH OF KNOWLEDGE

It has long been known that tsetse flies (*Glossina*) are limited, in many parts of Africa, to sharply-defined fly belts. In general these belts are easy to recognise by their characteristic vegetation: the fly belts are more dense and more evergreen than the surrounding country, which is often of grass with scattered trees. The fly belt is very widely spread in Africa, at least in those parts where there are seasonal rains: here the most widespread and characteristic of the tsetse flies is *Glossina morsitans*. It was probably Professor E. Roubaud who first looked at this problem as a scientist and tried to isolate and measure the factors. He pointed out that the waterside tsetse (*G. palpalis*) and the savannah tsetse (*G. morsitans*) are exposed to different climates. By means of experiments, carried out under very primitive conditions, he tried to investigate the effects of temperature and humidity (Roubaud, 1909).

In this address I propose to limit myself to work on the physical side, in the northern part of Nigeria and adjacent parts of Africa. I shall describe the development of knowledge of the effect of the climate on tsetse, and deal with its gradual application to tsetse control. A fuller account of the whole matter, and of work in the Gold Coast and elsewhere is given in my book (Buxton, 1955).

The north of Nigeria is interesting because the seasons are sharply distinguished. The end of the dry season is exceedingly hot with low humidity, winds coming in from the Sahara from the north and north-east. About the month of May the wind goes round to the south-west, bringing abundant moisture and rain and a dramatic lowering of the temperature. In this area a number of men have made separate, distinctive contributions to understanding the effect of climate on tsetse, approaching it from different directions.

Lloyd, Johnson and their colleagues published a series of papers from 1924 onwards. They described the topography of an area in the neighbourhood of Sherifuri, Northern Nigeria, in which two species of tsetse, *G. morsitans* and *tachinoides*, occurred. They emphasised the distinction between the thickets which are mostly on the banks of the rivers, and the open country, covered with tall grass and scattered trees. The sharp seasonal differences in the climate have a great effect on the distribution of *Glossina*. Both species are confined to the thickets and riverside during the hot, dry season; indeed, *G. tachinoides* does not spread widely from those places at any time of the year. *G. morsitans*, however, though closely circumscribed in the hot, dry weather, spreads far and wide, wandering through the savannah and establishing secondary breeding places away from thickets. These authors accepted a distinction made by Shircore (1914) in Nyasaland, between the primary foci of *G. morsitans*, which are permanent and associated with thicket, and the secondary foci, which are widespread areas occupied in the more clement season.

Lloyd and Johnson were pioneers in quantitative studies on tsetse. They

established fixed points at which the insects were caught week by week for several years, details of method being standardised and the results expressed as so many flies per fly boy per hour. These authors realised the important point that the number of insects caught is determined partly by the population but also by the activity of the flies. It became clear that there was a fairly regular seasonal change in the number of tsetse caught and in the proportion of females in the catch. Though wide divergencies were observed, some appeared to be capable of explanation in terms of what was already known of the biology of the insect.

It is significant and interesting that two of the papers published by this group (1927 and 1933) have the title " Experiments in the control of tsetse flies ". Lloyd, Johnson and their colleagues used their extensive knowledge of the insect and their quantitative data as a base for experimental types of clearing of vegetation along river banks ; they developed an experimental approach to the problems met with in operation in the field.

The present writer had had a considerable amount of experience in several parts of the tropics. It had been his good fortune to spend several years in desert or semi-desert climates, and then about two years in the equable, humid

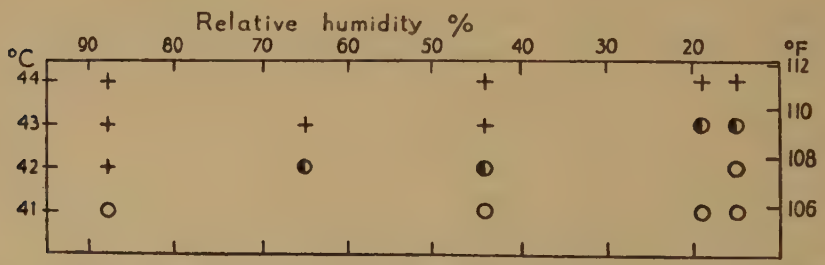


FIG. 1.—Groups of *Glossina morsitans submorsitans* were submitted to certain conditions of temperature and humidity for one hour. The cross indicated that all died, the black and white circle that some died, and the white circle that none died. (Buxton and Lewis, 1934.)

climate of the heavily forested islands of the South Pacific. This experience had impressed upon him the importance of the effect of climatic factors upon insects. After he became established in the London School of Hygiene and Tropical Medicine (from January, 1926) he and his colleagues began to seek ways of analysing climatic factors in the laboratory—no easy matter at that time. It became clear that the work published by Lloyd and Johnson from the northern parts of Nigeria, with the strikingly different seasons and seasonal cycles in tsetse, presented problems which could be studied in the laboratory. A visit was planned to the Tsetse Research Institute at Gadau, only a few miles from Sherifuri, where the earlier work had been done. With Mr. D. J. Lewis, I arrived there in the cold, dry season in January, remaining there for the period during which the temperature rose during March and April and seeing the striking effect of the rains which fell from May onwards, leaving finally in July. We equipped ourselves both for experiments in the laboratory on lines that were already familiar with other insects, and for recording changes in atmosphere and humidity through the twenty-four hours in the field (Buxton and Lewis, 1934).

Lewis and I defined the conditions of temperature and humidity that are fatal to *G. morsitans* and *tachinoides*, for various periods of exposure. The type of result we obtained is shown in fig. 1. It was established that the insects survive a rather higher temperature in drier than in moister air, presumably because they

are evaporating water and lowering their body temperature ; a temperature of 44° C. at any humidity is quickly fatal to both species after a brief exposure. It is remarkable, though the point escaped our notice at the time, that these insects which are exposed to conditions in the hottest belt of Africa, are killed by a raised temperature close to that which kills many other insects, including ones from northern climates. We also carried out more elaborate experiments maintaining a group of a dozen flies in a small cage at a controlled humidity and temperature. These flies were offered food daily and it was found that though they would live at 30° C. with a very wide range of humidity, they tended to die out more rapidly at low humidities.

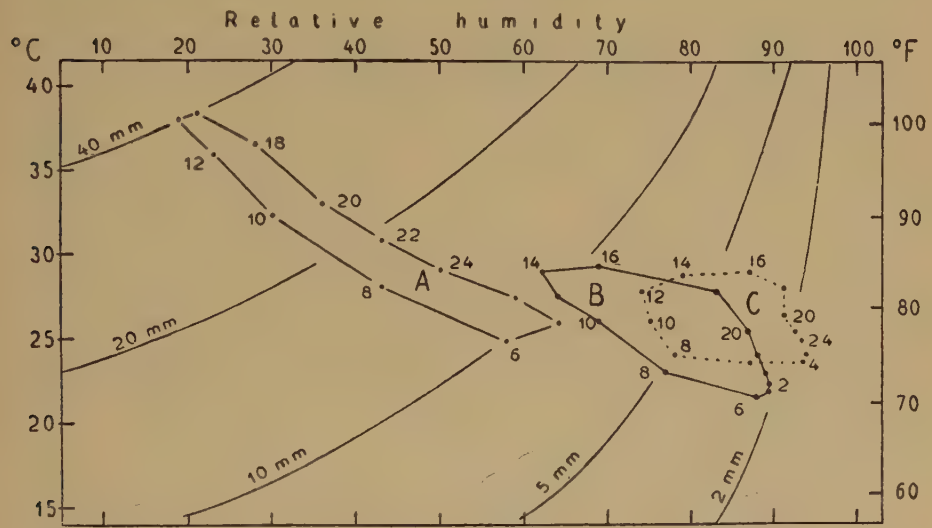


Fig. 2.—Graph showing mean temperature and humidity at two-hourly intervals (2, 4, 6, etc. = hours, on 24-hour system). Curves A and B, for April and July, taken from recording instruments exposed in Stevenson screens in an open exposure, at Gadau, northern Nigeria. Curve C gives conditions in a screen in dense thicket in July. (Buxton and Lewis, 1934.)

Buxton and Lewis also studied the climate in the places in which the tsetse were living, choosing two months in which the conditions were different. The figures for April (hot and dry) and July (cool and wet) were obtained by exposing thermohygrographs in Stevenson screens close to the ground in thickets (fig. 2). It surprised us to discover that temperature in the insects' haunts may be close to what we ourselves had just shown to be fatal. We found, for instance, that in April the temperature in the thicket passed 40° C. on five different days ; once it exceeded that figure for a period of more than two hours. Similar instruments have been exposed, outside the thicket, in a position which the meteorologist would regard as satisfactory. These temperatures were only a little above those in the thicket ; but temperatures dangerously high for the tsetse were more frequent in the open and prevailed for longer periods (Buxton, 1955, p. 233).

Dr. T. A. M. Nash, who had already studied *Glossina morsitans* and other tsetse in East Africa, arrived in the north of Nigeria while Lewis and I were carrying out our experiments. Bearing in mind what we had demonstrated, and particularly the striking fact that in the thicket the temperature may rise to a point likely to be lethal to tsetse, he carried the investigations back into the field (Nash,

1935, and later papers). Establishing his recording instruments in a number of different types of vegetation throughout the year, he confirmed that in the hot season climatic conditions were not very different in the thicket and the open "meadow pan". But he found that conditions unfavourable to tsetse occurred for a much shorter part of the year in the thicket than they do outside: for instance, during several years, evaporation in the thicket exceeded 50 c.c. for two months, in the meadow pan for seven; high temperatures prevailed for a longer season outside the thicket than inside it, and so forth. Nash also confirmed what had been shown by Lloyd and Johnson, that the local species of tsetse were confined to thickets in the hot dry season, spreading to the more open savannah in the rains, *morsitans* to a much greater extent than *tachinoides*. He also produced grounds for supposing that there is a high mortality during the season of extreme climate. Experiments were carried out under semi-natural conditions,

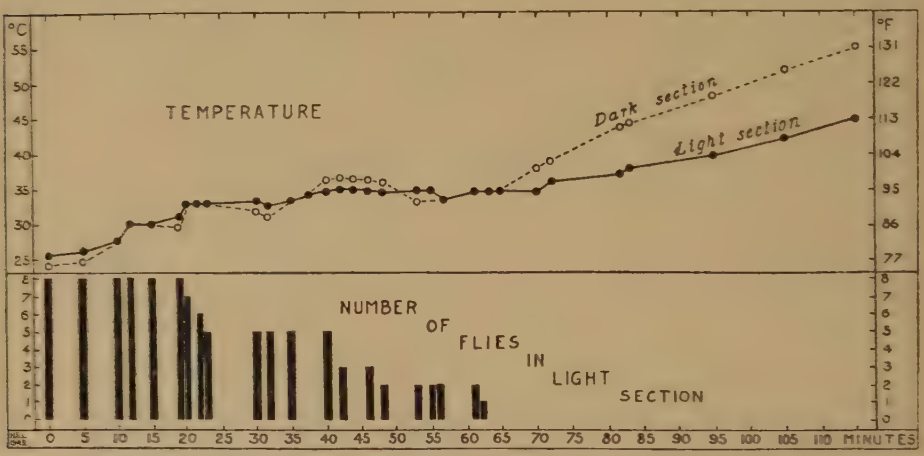


FIG. 3.—Tsetse are exposed in a long narrow box, one section lit from above and one section dark. The temperature in the two sections is raised gradually, but not to the same extent. At a certain temperature (about 35° C.) the flies move over from the light to the dark section. (Redrawn by H. S. Leeson from Jack and Williams, 1937.)

flies being kept in small cages beneath a thick thatch open at the sides, and fed once a day. In the cold weather the flies under the thatch generally lived some fifty days, but in the hottest month only two or three. Moreover, deaths were particularly numerous if there was a short spell of very hot weather with shade maxima passing 39·5° C., which Nash came to regard as critical. Seasonal differences in longevity were confirmed by capturing flies (of unknown age) marking and releasing them. Recaptures indicated a maximum life of one month in hot weather, of two and a half to three in other seasons.

So far, then, Nash's work tended to define the puzzle that the insect can live in these thickets though, as it seems, during very hot weather the conditions must be lethal to it. The explanation was reached in subsequent work in which Nash took account of the temperature very close to the ground in the thickets. A thermohygrograph very close to the ground never recorded temperatures so high as those which could be found a few feet higher in the air: for instance, during fifty-two days of the hot season from 10th April at Gadau the mean maximum temperature on the ground in different spots was 33·8–34·3° C., but 3 or 4 ft. higher in the same thicket it was 37·2–38·4°. There were similar differences,

probably very significant, in the absolute maximum. There were also interesting differences in the number of days in which the temperature passed certain figures ; the differences might appear trivial, but they are in the zone of temperature which is critical to the survival of the insect. It was also found that the insects did not attack man during the hot hours of the day, when they could be observed sitting on the ground or close to the bases of trees. Clearly then the explanation of the puzzle lies in this, that the insects owe their survival to selecting the most favourable spots within the thicket (Nash 1935, 1936*a* and *b*).

At this point we may once again take the problem into the laboratory and consider the experimental work of Jack and Williams (1937) on *Glossina morsitans* in Southern Rhodesia. A long narrow box was made with a glass lid, covered at one end so that there was a dark and a light section. It was possible to raise the temperatures of the dark and light part of the box to different levels. When

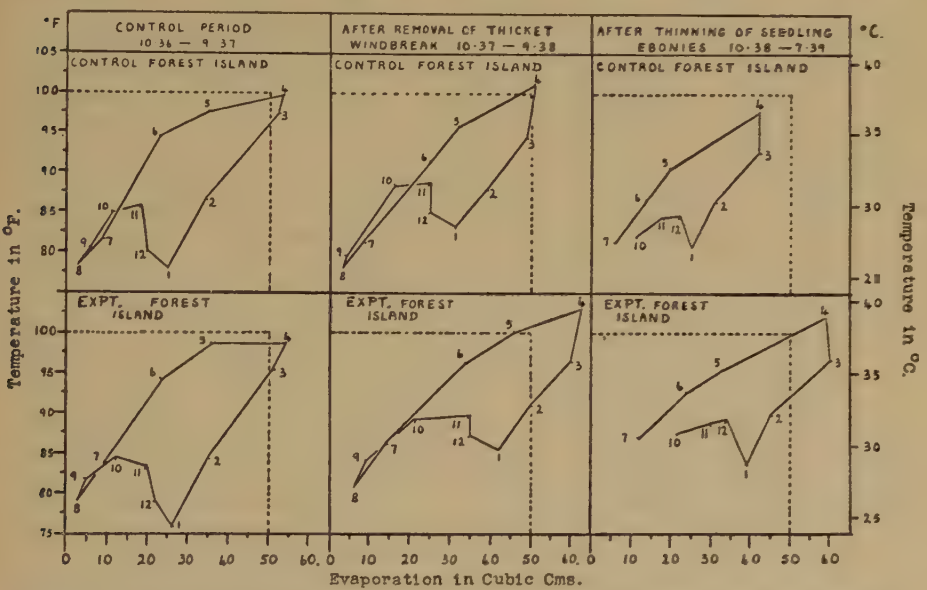


Fig. 4.—In each section of the figure the climatograph curve unites the points of mean monthly shade temperature and evaporation. The numbers 1, 2, etc., signify months. The three upper sections give the conditions in three years in an untouched ' control ' " forest island ". The three lower curves give the corresponding conditions in a similar " island " subject to progressive thinning of vegetation. (Nash, 1940.)

tsetse were put in this box they tended to settle down in the light part. In the particular experiment shown in fig. 3 temperature in both parts of the cage rose equally for the first sixty-five minutes, when it had reached 35° C. From that point onwards the flies which had been under the light passed over into the dark. The temperature of the dark part of the cage was then raised more rapidly ; even so the insects persisted in remaining in it ; they died there when the temperature reached what was fatal. The reversal of behaviour so clearly demonstrated in these experiments surely illuminates Nash's observations on the activity of the tsetse, exposed in nature to temperatures which rose into the zone dangerous for them and then seeking resting spots which were dark : the observations in Nigeria and experiments in Rhodesia surely support and explain one another in a satisfactory manner.

Returning to work in the field we must point out that the clearance of riverside thicket is an " obvious " way of controlling species of *Glossina* : it has been used for a long time and with evident success. In the north of Nigeria this type of clearing was the subject of the experiments of Lloyd and Johnson already referred to. In the hands of Nash, and with the experimental data referred to above, clearance of vegetation in permanent haunts of tsetse was to become a more precise measure of control. One may claim that the determination of such matters as the thermal death point, which might appear to be of interest only to academic people, proved (as no one could have expected) to be the key to economical control of tsetse in the field. It became clear that conditions in the thickets required to be modified so that the high temperature, dangerous to the insect, which occurred outside would also prevail inside the thicket, and for as long as possible during the hot dry season. The investigations of Nash are illustrated in fig. 4. He selected two small thickets, close to one another and similar, in the neighbourhood of Gadau, Northern Nigeria, and measured climatic factors in them. The mean values for temperature (°F.) and evaporation are shown in the six curves in the figure, the upper three showing conditions in three different years in the one thicket which was never subjected to clearing. The dotted lines in each small figure define 100° F. and 50 c.c. of evaporation ; it was Nash's opinion, based on long experience, that when temperature and evaporation passed those figures the conditions became dangerous for the two species of the tsetse (*G. tachinoides* and *morsitans*). It will be noted that there were considerable differences from year to year. The three curves in the lower part of the figure show the conditions in the second thicket. In the first year it had not been touched ; conditions in it and in the control thicket were closely similar. In the second year a dense mass of creepers, which grow somewhat like brambles, but belong to the genus *Acacia* and which act as a wind break all round the edge of the thicket had been removed. The effect on climatic conditions, particularly in the hot dry season, is evident on comparing the mean temperatures and evaporations for February, March, April and May. It is evident that the creepers had formed an efficient barrier ; their removal allowed climatic conditions to exceed the danger lines and to do so for a substantial part of the year. This was accompanied by a pronounced fall in the number of adult *tachinoides* captured by the fly boys, and the deposition of puparia within this experimental thicket practically ceased : the numbers of *G. morsitans* were only slightly affected. In the third year of the experiment, small seedling trees were removed from the inside of the experimental thicket, an event which still further increased the unfavourable climatic conditions in it, as may be seen by comparing the two right-hand curves. The upper one, that of the unaltered thicket, shows that climatic conditions continued relatively mild, indeed in that year the mean figures never passed the danger limits ; whereas in the experimental thicket there was a considerable period in March and April during which dangerous conditions prevailed. But even this clearing within the thicket did not produce a reduction in the numbers of *G. morsitans*, though adult *tachinoides* fell to an eightieth of the numbers caught in the control thicket (Nash, 1940).

When he came to apply methods such as these to the practical elimination of species of *Glossina* from large areas, Nash found that it was impossible to state in general terms that a certain amount of clearing would be sufficient to eliminate certain species of tsetse : one could only say this for a particular climatic zone. For instance towards the north of Nigeria where the physical conditions were in any case dangerous to tsetse at the hot dry season, relatively little clearing would turn the balance against them. But nearer the centre of the country, where temperature and dryness were never so extreme, it was necessary to clear more

vegetation to achieve control of these insects. The easiest problem lay in the north, where one may exploit the fact that severe natural conditions are hardly tolerable to *Glossina*. In general, Nash found that, if sufficient clearing were carried out to control *G. tachinoides*, *palpalis* would generally disappear : *morsitans* was more difficult to control, at least by this method.

The control of tsetse in the northern part of Nigeria and similar savannah areas in West Africa is important because there is a very large area of grass on which cattle can only graze at risk of trypanosome diseases. The tsetse flies, particularly *G. morsitans*, therefore materially reduce the potential wealth of the country by denying the use of much of this grass to cattle. The most effective control of the disease is the elimination of tsetse. On the other hand, the control of human sleeping-sickness, also, of course carried by tsetse flies, has already been achieved by the widespread use of appropriate drugs, so that that disease has become of secondary importance.

Making use of the methods of discriminative, or partial clearing, such as those described above, widespread campaigns were carried out, and are still being extended, giving protection to considerable parts of the north of Nigeria. The most notable of these was the Anchau Rural Development and Resettlement Scheme, interesting because work against tsetse was combined with measures of general improvement of health, nutrition and so forth. The work was entirely carried out by the Medical Department of Nigeria. Dr. T. A. M. Nash's knowledge of tsetse, and also of the villagers and their requirements, permitted him to carry out this successful, indeed brilliant, piece of work. One should not forget the name of the late Dr. H. M. O. Lester, who secured adequate funds and gave due emphasis to rural development in general. The Anchau area was one in which there had been grave epidemics of sleeping-sickness in the human population followed by depopulation. It was suitable for a large practical demonstration, partly because it was accessible so that, if the work was successful and the population increased, there were facilities for the export of surplus crops, hides and so forth. After survey it was decided to eliminate tsetse completely from an area about seventy miles by ten. *Glossina morsitans* was absent, but the two waterside tsetse (*G. palpalis* and *tachinoides*) occurred very widely throughout the area along the banks of the numerous streams. Most of these ran only in the rains, and there was approximately one mile of stream to each square mile of land : the entomological problem was therefore large, though simple. The amount of clearing necessary to expel tsetse from this type of country was already known. All thickets growing on the banks of streams and all low-branching trees in the same places were removed but trees with clear stems and high branches were left. There were also marshy areas with thickets of the palm *Raphia*, congenial to the waterside tsetses. Appropriate treatment of all these places could be relied on to exterminate these insects during the dry season. But it was known that during the rains they would work their way up the cleared streams from the larger rivers which were outside the area being dealt with. To stop that type of invasion a complete "ruthless" barrier clearing a mile long was made and all trees were removed from the banks of rivers where they left the Anchau area. The work was successful, tsetse being eliminated and the population resettled so as to make better use of the land, and so as to be able to maintain themselves permanently against tsetse. The increase and improvement of the local cattle (which had been practically absent beforehand) and of markets and roads, led to a great increase in the wealth of the community (Nash, 1948).

One could hardly expect to find a better example of the gradual development of knowledge of a serious problem and of its solution. The story has developed during a quarter of a century, from the first publications of Lloyd and Johnson (1924) to Nash's Anchau report (1948). Early in that spell of time field observa-

tions and crude field experiments suggested laboratory work, which in turn defined problems to be taken back to the field. A healthy exchange of points of view and methods between different men occurred ; one cannot say that one man or one technique defined the problem or led to its solution. But even now one fundamental question remains unsolved. Is the distribution, population and biology of these insects influenced directly by physical factors? Or are the factors generally biological, operating through the vegetation?

This piece of entomological history covers a considerable span of years, and I would maintain that if the Government of Nigeria and the Colonial Office had become impatient and demanded " results " at an early date, the work would not have developed in this satisfactory way and could not have been as effective as it eventually was.

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